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Evaluating player experience for children's outdoor pervasive games

Iris Soute *, Saskia Bakker, Remco Magielse, Panos Markopoulos

Department of Industrial Design, University of Technology Eindhoven, P.O. Box 513, 5600 MB Eindhoven, The Netherlands

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ABSTRACT

There is a growing body of research in pervasive outdoor gaming, mainly focused on adult players playing games on smart phones. Published evaluations of the player experience in such games are largely based on anecdotal descriptions and post-play surveys. The latter approach is especially challenging to apply when the play test participants are children. Observations of game play so far have been ad hoc relying on unstructured observation, which makes it difficult to extract reliable conclusions from observations and to draw comparisons between different games. In this paper we present two methods developed specifically for evaluating the player experience in children's outdoor games: the Outdoor Play Observation Scheme (OPOS) and GroupSorter. We discuss their application in three different case studies and conclude that OPOS is useful in quantifying the different types of play behavior in outdoor games; GroupSorter adds qualitative data on the play experience. Moreover, the application of GroupSorter is not limited to game development but can be used for obtaining user input in other context as well.

1. Introduction

A consequence of the current wide adoption of mobile computing is the emergence of *mobile and pervasive gaming*, where mobile interactive devices with computing and communication capabilities (typically smart phones) are used to play games outdoors. These games may involve one or more players who may be distributed or co-located, and where game play can take place in the broad variety of locations and contexts where one might expect such mobile devices to be used. This class of games represents a vast new growth area for mobile interactive technologies but also, we argue, a new set of methodological challenges relating to the user centered design of related systems. Research in this area has progressed largely in terms of developing research prototypes and charting the related technical, interaction, and game design challenges. For example, the pioneering pervasive game *Can You See Me Now?*[1] is a mixed reality chasing game intended for adults dispersed in an urban environment; the emphasis of the researchers was on exploring and demonstrating the limitations but also the opportunities related to creating pervasive games that rely on Wi-Fi and GPS infrastructures. Similar examples are *CatchBob!* [2] and *Feeding Yoshi* [3]. In these projects the evaluations are focused more on the technological innovations, and on exploring the nature of the emerging user experiences and less on the ambition to just create a fun and playable game.

As the transition is made between the initial pioneering phase to more routine development and eventually adoption of such games, the need emerges for appropriate evaluation methodology. To this point there has been no systematic effort on this front. Partly, this is a consequence of the novelty of the field: by its nature methodology research inevitably lags behind design innovations. Then again it could reflect expectations by designers and researchers, that traditional user centered design methodology [4] or more recently experience design [5] suffices for the purposes of mobile and pervasive game design, perhaps with minor or major adaptations to fit the specific design context. While for many cases this may hold true, our particular interest in designing mobile and pervasive games for children leads us to a different position.

The research reported here is part of an investigation into an emerging genre of mobile and pervasive games intended for children players; we use the term Head Up Games (HUGs) to describe co-located outdoor games supported by technology and targeting children. Head Up Games were introduced by Soute et al. [6,7] in juxtaposition to the prevalent, at that time, interest of the research community on games for adult mobile players that superimpose a virtual world onto physical environments. Typically such games require players to play 'head-down' attending their mobile device and interacting through the mobile devices and network rather than directly with co-located players. While such games do have substantial merit, it is especially so that young children need rich face-to-face social interaction and intense physical activity typical of their non-technology based outdoor games, for developing their social and physical skills [8] and flexibility with respect to the physical context. In Soute and Markopoulos [6] and Soute et al. [7] we put forward Head Up Games as a reaction to pervasive games for adults, aiming to inject modern pervasive gaming with

* Corresponding author. Tel.: +31 40 247 5228; fax: +31 40 2473285.
E-mail address: i.a.c.soute@tue.nl (I. Soute).

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some of the traits and advantages that have characterized traditional outdoor play for children over the centuries.

Comparable motivations have inspired researchers to explore interactive games and playful installations, where children can play together and where physical activity is an inherent part of the play experience. Examples of such research are interactive games that support exertion [9], interactive installations that support groups to by physically active such as the interactive slide or the interactive fountain [10], the enhancing sporting with sensor based interactive technology [11], etc. A common goal for all these genres of interactive technology is physical activity and social interaction and, of course, the designer's intent to embed these in an engaging and fun activity. These shared design goals bring about recurring methodological challenges with regards to evaluation. The involvement of children already presents a distinct set of methodological challenges for evaluators that require either the adaptation of evaluation methodologies originally developed for adult test participants or the invention of novel evaluation methods [12]. Further, the mobile context, the physical activity and the open space, limit the applicability of testing methods originally intended for a laboratory context and a static interaction platform such as a desktop computer.

In the next section we elaborate these two points, in order to motivate the development of specialized methodologies for testing mobile games for children and we review relevant, existing research in similar areas. Next, we present two methods we have developed specifically for the purpose of evaluating outdoor games with children; the Outdoor Play Observation Scheme (OPOS), a structured observation method for evaluating emerging play behaviors, and GroupSorter, a method suitable for children age 7 and up, that enables evaluating the experienced fun as well as the rationale behind it. Section 4 provides the details on the application of both methods in three case studies. Subsequently, Section 5 reflects on the usage of the methods and provides ideas for further improvement. Finally, we conclude with a discussion in Section 6.

2. Related work

This section is divided in three parts: a review of existing evaluation methods for play, games and physical activity in general, a review of games that have been developed that are closely related to Head Up Games, and, concluding, a review of child-centered usability evaluation methods.

2.1. Related evaluation methods

Let us start this review by stating that there are many different definitions of both 'play' and 'games' and that there exists a 'surprisingly complex relationship' [13] between the two. Furthermore, there are many theories on why play exists and the role of play in child development; for an overview of both classic as well as modern theories we refer the reader to [14]. As there is no consensus on the exact definition of 'play' it is not hard to see there exists no 'gold standard' for assessing play, and, unsurprisingly, many different approaches in as many different disciplines are taken. We highlight several of these, though this is by no means an exhaustive review.

2.1.1. Study of play

In the area of developmental psychology play is regarded as an essential aspect in a child's development [8] and studies of children's play often focus on the social development of young children. Assessment of children's play is most commonly done by observation.

For instance, Parten [15] conducted one of the very first observational studies of children's play. She defined an observation scheme to study the social participation of preschoolers (2–4 year) in spontaneous play using a one-minute sampling method. For 4 months, children were observed 1 h per day in which they were free to choose what and with whom to play. Parten defined a scale for classifying children's social participation in play, ranging from non-social play ('solitary play') to play involving high social participation ('cooperative or organized supplementary play'). From her observations she concluded that the social participation increases with age [15].

Rubin's [16] Play Observation Scheme (POS) combined Parten's work with the Smilansky classification of play behavior in an observation scheme that classifies both social play and cognitive play. POS has been used in several projects investigating the free play behavior of preschoolers, e.g., [17] and [18]. Rubin [17] applied POS to compare free-play behaviors of preschool- and kindergarten-aged children. One of the main conclusions that was drawn, was that kindergarten children engage more in group and dramatic play than preschool children. Hetherington et al. [18] applied a slightly modified version of POS to study the effect of divorce on social interaction and play on preschool children. The children were observed during six sessions over the course of 2 years after their parents divorced. Based on the results Hetherington et al. concluded, amongst others, that compared to children of non-divorced families play patterns of children from divorced families were more fragmented and less socially mature during the first year after the divorce.

Metin [19] studied children's play in a playground and the effect of the equipment design on their play behavior. She classified behavior in behavior patterns (e.g., talking, pretending) and play types (e.g., sensorimotor play, pretend play, games with rules). 70 children, aged 6–12, were observed in a park; after the observation session a short interview was conducted. The results of the study showed that today's playground has little value in terms of play. Physical and social developments are supported to an extent, however cognitive and emotional development are not fostered.

2.1.2. Study of games

Up until the arrival of computer games, the study of games was sparse. A few notable exceptions are Johan Huizinga [20] and Roger Caillois [21] who discussed games from the perspective of culture and sociology. However, as computer games rose in popularity, the interest from the academic field into gaming also grew. For example, the influence of violent video games on aggression has often been studied [22,23]. Experiments typically use questionnaire data, sometimes combined with physiological measurements, to asses the participant's attitude towards violence, aggressive behavior, aggressive affect or aggressive cognitions.

The application of digital games for children has often been studied from an educational perspective [24]. Typically in the field of HCI educational games are evaluated using cognitive tests, questionnaires (e.g., [25]), and interviews (e.g., [26]).

Social aspects of video games that are studied are e.g. the feeling of presence [27], player enjoyment and engagement [28]. De Kort et al. developed the Social Presence in Gaming questionnaire (SPGQ) to measure the player's feeling of social presence in digital games. Chen et al. interviewed MMORG (Massively Mulitplayer Online Role-playing Games) in a semi-structured interview to get a holistic account of the players gaming experience.

Finally, digital games are also researched to find out what makes them fun for children [29]. To this end Barendregt et al. have developed the PIPC method: the problem identification picture cards method. This method combines the traditional think aloud method with picture cards that indicate certain types of usability